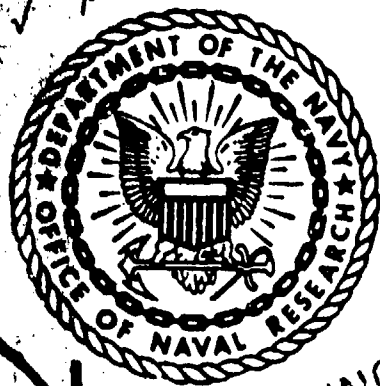


UNCLASSIFIED

AD NUMBER
ADB955507
NEW LIMITATION CHANGE
TO Approved for public release, distribution unlimited
FROM Distribution limited to DoD only; Critical Technology; 26 Mar 84. Other requests must be referred to Naval Research Lab., Attn: Code 1221. Washington, DC 20375.
AUTHORITY
Naval Research Laboratory, Technical Library, Research Reports Section Notice, dtd October 10, 2000.

THIS PAGE IS UNCLASSIFIED



AT1 6446

CONFIDENTIAL

COPY NO. 4

7152

UNANNOUNCED

NAVAL RESEARCH LABORATORY REPORT

AD B955507

UPPER ATMOSPHERE RESEARCH
REPORT NO. 2

PART 2
IONIZATION EXPERIMENTS
IN THE V-2

NRL REPORT NO. R3031

CLASSIFICATION CHANGED TO UNCLASSIFIED
BY AUTHORITY OF DoD DIR 5200.10
ON 5/22/61 Reference Authority
(DATE)

Signature of Director
NAVAL RESEARCH LABORATORY

DTIC
ELE
APR 13 1964
A

DTIC FILE COPY

UNCLASSIFIED

NAVY DEPARTMENT

PROPERTY OF

DOD DIR 52CC.10

CIR. 1000

Norma Rayner 2028

HAL 0033

Navy Department - Office of Naval Research

NAVAL RESEARCH LABORATORY
Washington, D. C.

RADIO DIVISION I
ROCKET-SONDE RESEARCH SECTION

30 December 1946

UPPER ATMOSPHERE RESEARCH
REPORT NO. II
-PART II-

by

M. Becker, R. E. Bourdeau
and T. R. Burnight

Report R-3031

~~CONFIDENTIAL~~

UNCLASSIFIED

Approved by:

Dr. E. H. Krause, Head
Rocket-Sonde Research Section
Dr. J. M. Miller, Superintendent
Radio Division I

Commodore H. A. Schade, USN
Director, Naval Research Laboratory

Preliminary Pages a-d
Numbered Pages. 3
Number of Figures 5
Distribution. e-h

~~CONFIDENTIAL~~

CLASSIFICATION CHANGED TO UNCLASSIFIED
BY AUTHORITY OF DoD DIR 5200.10
ON 5/22/61 (DATE) Anthony E. Thomas
Reference Authority
Signature of Custodian

DISTRIBUTION STATEMENT E: Distribution limited to DoD
only:
Other requests must be referred to:
26 MAR 1984

UNCLASSIFIED

DISTRIBUTION

No. of Copies

- (16) ONR-Planning Division; Program Subdivision; Armament and GM Section; Scientific Subdivision(4 copies); Geophysics Section; Electronics Section; Physics Section; Publication Liaison; Scientific Subdivision; Tech. Information Section(4 copies).
- (1) ONR-SDC, Sands Point, Port Washington.
- (17) CNO-OP-05; OP-06; OP-03; OP-503; OP-601; OP-413; OP-413C; OP-04/06; OP-100F; OP-57(5 copies); CinCLantFlt; CinCPacFlt.
- (13) BuAer-Aer-E-18; Aer-E1; Aer-E1-35; Aer-SI-50DAS(2 copies); Aer-PA; Aer-TD-4(6 copies).
- (9) BuOrd-Adlf; Ple; Re; Rea; Re-9(4 copies).
- (11) BuShips-Code 330; Code 900; Code 910; Code 918-L.O.; Watson Labs; Code 920; Code 938(2 copies); Code 343(4 copies).
- (2) PG School-Annapolis
- (1) Naval Observatory
- (1) NGF Washington
- (6) MarCorps-Military Sec. G-3(3 copies); G-3, Spec. Weapons (2 copies); Secretary Special Board, MarCorps Schools, Quantico.
- (2) OinC BOEU-NBS, Att: Dr. H. C. Dryden
- (1) NEI-San Diego
- (2) NOFTLO-MIT
- (2) NOEL-Washington
- (1) NOIS-Inyokern
- (1) NOTJ-WSPG
- (1) NPG-Dahlgren
- (4) NavOrdDev.U.-APL
- (3) NAMTC-Pt. Mugu
- (4) NRL Field Group-WSPG
- (1) SNLO-USNELO-Ft. Monmouth
- (1) BAGR-ED, 90 Church St., N.Y.
- (1) BAGR-WD, 624 Van Nuys Bldg., Los Angeles
- (1) BAGR-Wright Field, Att: Lt. Col. J. A. Gerath
- (1) NATC-Patuxent River, Md.
- (1) NAES-Philadelphia
- (1) NAOTS-Chincoteague, Va.
- (2) ComOpDevFor-FPO, N.Y.
- (1) NAMC-Philadelphia
- (2) NAMU-Johnsville
- (1) DTMB-Washington, Attn: Aero Mechanics Div.

CONFIDENTIAL

UNCLASSIFIED

UNCLASSIFIED

DISTRIBUTION(Cont'd)

little on file

1-4



No. of Copies

- (1) BuOrd-Experimental Unit, NBS
- (1) ASO-Philadelphia
- (1) USNA-Head, Ord. & Gun, Annapolis
- (1) NAF-Philadelphia
- (1) Sec. of War-Washington
- (9) CG-AAF, Attn: AC/AS-4; DRE-3
- (22) CG-AMC Wright Field, Attn: TSEON-2
- (1) Air Univ., Maxwell Field, Ala., Attn: Air Univ. Library
- (1) AMC-Watson Labs, CFS, Cambridge, Attn: Mr. H. Stockman
- (2) AMC-Watson Labs, Electronics Subdivision TSESA-7, Wright Field
- (1) AMC-Watson Labs, WLERR, Eatontown, N.J.
- (4) Ch/ORD-Rocket Dev. Div.(2 copies); Sub Office (Rockets)
CIT; Sub Office (Rockets) Ft. Bliss.
- (1) 1st AAAGMBn.-WSPG
- (1) CG-Manhattan Engr. District
- (1) Com. and Staff Col., Ft. Leavenworth, Kansas
- (1) ABL-Aberdeen-C.G. Aberdeen-Ballistic Research Lab.
- (5) OCSigO-Eng. & Tech Ser; Eng. Div(2 copies); SPSOI-4.
- (1) ESL-Selmar, N.J.
- (2) SCEL-Bradley Beach, N.J.
- (1) NLO-SCEL-Ft. Monmouth, N.J.
- (1) Chief of Chemical Corps-Washington
- (1) Chief GM Br., Tech. Command-Edgewood Arsenal, Md.
- (1) PGC-Eglin Field, Fla.
- (1) Antiaircraft Artillery School-Ft. Bliss, Tex.
- (1) Frankford Arsenal-Philadelphia.
- (1) Wendover Field, Wendover, Utah
- (6) AGF-Ft. Monroe, Va; Seacoast Service Test Sec., Board No. 1,
Ft. Baker, Cal.; Board No. 1, Ft. Bragg(2 copies); Board No. 4,
Ft. Bliss(2 copies).
- (2) US Mil.A.-West Pt., N.Y., Attn: Prof. of Ord.
- (1) Director of Research and Dev., War Dept. Gen. Staff-Washington
- (1) Ch/Ord, Research & Dev. Ser., Ammunition Dev. Div.
- (1) Air Tactical School, Air Un.-Tyndall Field, Fla.
- (2) JRDB; JRDB-GM Committee
- (1) Ord. Advisory Com. on GM-Gen. Radio Co., Attn: Dr. H. B. Richmond
- (2) Armed Forces Staff College-Norfolk, Va.
- (4) NACA-Washington, Attn: Mr. C. H. Helms
- (3) OinC, R & DS Suboffice(Rocket) Cal Tech for Jet
Propulsion Lab.
- (1) SDC, ONR, Sands Point, Attn: Technical Information Desk

CONFIDENTIAL UNCLASSIFIED

UNCLASSIFIED
DISTRIBUTION(Cent'd)

No. of Copies

- (2) ✓ Dev. Contract Officer, Cornell Aero. Lab-Att: Dr. C.C. Furnas
- (3) ✓ Dev. Contract Officer-APL, Johns Hopkins
- (4) ✓ Chairman, MIT, GMC Project Meteor Office, MIT, Cambridge, Mass.,
Attn: Dr. H. G. Stever
- (3) ✓ U. of Mich-Att: Dr. Dow; Mr. Robert T. May; Mr. M. B. Small
- (2) ✓ Penn State U-Att: Haller, Raymond and Brown
- (5) ✓ Princeton U-Att: Project SQUID(3 copies); Dr. J. A. Wheeler;
Dr. H. D. Smyth.
- (1) ✓ U. of Texas-Att: Dr. C. P. Boner, Via Dev. Contract Officer
- (2) ✓ BAR, Pasadena, Cal. for Aerojet, Att: Dr. F. Zwicky;
W. E. Zisch
- (2) ✓ BAR, Cornell Aeronautical Lab, Buffalo for Bell Aircraft,
Niagara Falls, Att: Mr. R. H. Stanley, Mr. B. Hamlin.
- (3) ✓ BAR, Buffalo, Bell Aircraft, Niagara Falls, Att: Mr. B. Hamlin
Mr. R. H. Stanley
- (2) ✓ Bell Telephone Labs. Attn: Dr. W. A. MacNair
- (3) ✓ Bendix Avia. Corp. Teterboro, Att: Dr. Harner Selvidge
- (1) ✓ Boeing Aircraft-Att: Mr. R. H. Nelson
- (2) ✓ Dev. Contract Officer-Consolidated Vultee, Daingerfield, Texas
- (2) ✓ BAR-Consolidated Vultee, San Diego, Att: C. J. Breitweiser
- (3) ✓ BAR-Consolidated Vultee, Downey, Cal., Att: C. R. Irvine,
Mr. W. W. Robinson
- (2) ✓ BAR-Curtiss Wright Corp., Att: Mr. Bruce Easton
- (1) ✓ Curtiss-Wright Corp., Att: Mr. R. Darby
- (2) ✓ BAR-Douglas Aircraft-Att: Mr. E. H. Heinemann,
- (2) ✓ Douglas Aircraft-Att: Mr. R. E. Raymond; Mr. E. F. Burton
- (2) ✓ NIO-Eastman Kodak, Att: Dr. Herbert Trotter
- (2) ✓ BAR-Fairchild Engine & Aircraft Corp., Att: Mr. J. A. Sloan
- (2) ✓ NAMU, Johnsville, Pa. for Franklin Inst. Labs-Att: Mr. R. H.
McClarren
- (4) ✓ Dev. Contract Officer for Gen. Elec. Co., Schenectady-
Att: Mr. J. W. Frick; Mr. G. K. Megerian(2 copies)
- (3) ✓ General Elec. Co., Schenectady, Att: Dr. R. W. Porter;
Mr. S. A. Schuler, Jr.; Mr. Phillip Class.
- (2) ✓ BAR-Glenn L. Martin Co., Att: Mr. W. K. Ebel.
- (1) ✓ Glenn L. Martin Co., Att: Mr. W. B. Bergen
- (1) ✓ INM-Globe Corp., Attn: Mr. J. A. Weagle
- (2) ✓ BAR-Goodyear Aircraft Corp., Att: Dr. Carl Arnstein
- (1) ✓ Goodyear Aircraft Corp., Att: Mr. A. J. Peterson
- (2) ✓ BAR-Grumman Aircraft, Bethpage, L.I., N.Y., Att: Mr. Wm. T.
Schwendler.

UNCLASSIFIED

DISTRIBUTION(Cont'd)

No. of Copies

- (4) BAR-El Segundo, Cal. for Hughes Aircraft Corp., Att:
Mr. B. W. Hopper; Mr. D. H. Evans
- (2) BAR-Kaiser Fleetwings, Inc., Att: Mr. Carl DeGanahl
- (2) INM-Kellogg Corp.
- (2) INM-M. W. Kellogg
- (1) M. W. Kellogg Co., Att: Dr. G. H. Messerly
- (2) BAR-Lockheed Aircraft Corp.
- (2) BAR-McDonnell Aircraft Corp., Att: W. P. Montgomery
- (2) BAR-North Amer. Avia., Att: Dr. Wm. Bolley
- (1) Northrop Aircraft, Inc.
- (1) Radio Corp. of America, Att: Mr. T. T. Eaton
- (1) Radioplane Corporation
- (2) INM-Raytheon-Att: Mr. R. C. Saunders
- (2) BARR-Reaction Motors
- (1) Republic Avia. Corp., Att: Dr. Wm. O'Donnell
- (1) Ryan Aero. Co., Att: Mr. B. T. Salmon
- (2) INM, Baltimore for S. W. Marshall Co.; Washington, D.C.
- (2) INM-Sperry Gyroscope Co., Great Neck, L.I., N.Y.
- (2) BARinC, Downey, Cal. for Willys-Overland Motors, Inc.,
Att: Mr. Joe Talley
- (2) BAR-Wright Aero. Corp., Woodridge, N.J.
- (2) BAR-United Aircraft Corp., Chance Vought Aircraft Div.,
Att: P. S. Baker
- (2) BAR-United Aircraft Corp., Pratt & Whitney Aircraft Div.,
Att: Mr. John G. Lee
- (4) CNO-OP-32 for distribution to
BAM(2 copies)
BCSO(2 copies)

UNCLASSIFIED
CONFIDENTIAL

UNCLASSIFIED

LIST OF FIGURES

1. Circuit diagram of transmitter, klystron monitor, receiver and power supply.
2. Ionization electronic equipment.
3. Warhead installation showing electronic equipment and waveguide.
4. A section of the telemetering record. The features of interest have been labelled, and a scale indicating time in seconds before takeoff has been added.
5. Attenuation of 10,000 mc. radiation in the exhaust of the V-2 as a function of time.

UNCLASSIFIED

TABLE OF CONTENTS

	Page
ABSTRACT	i
IONIZATION EXPERIMENTS IN THE V-2 - M. Becker, R. E. Bourdeau and T. R. Burnight	1
1. Introduction	1
2. Instrumentation	1
3. Experimental Results	2
4. Conclusions	2
5. Future Research	3

UNCLASSIFIED
CONFIDENTIAL

UNCLASSIFIED

ABSTRACT

This report continues the description of studies of the attenuation experienced by 10,000 mc. radiation in the V-2 exhaust. Particular emphasis falls upon the measurements made in connection with the October 10 firing, and the improvements incorporated into the installations for that flight are given in detail. The experimental data are discussed and the value of 14 db/meter is found to be in general agreement with the results obtained in the first cycle of V-2 firings.

CONFIDENTIAL

UNCLASSIFIED

h.

CONFIDENTIAL

PART II

IONIZATION EXPERIMENTS IN THE V-2

by

M. Becker, R. E. Bourdeau,
and T. R. Burnight

1. Introduction. The studies of the attenuation of 10,000 megacycle radiation by the exhaust of a V-2 rocket during flight are continuing. The experimental installations employed in the first cycle of V-2 firings, and the results obtained, were given in detail in Upper Atmosphere Research Report No. I, Part II*. These findings were extended in some particulars by measurements made during the first of the flights which comprised the second cycle of V-2 firings. The equipment used differed in several respects from that employed in the first series of experiments. The important additions and changes incorporated into the October 10 flight are described in the following paragraphs.

2. Instrumentation. Experience obtained in previous flights showed that the primary difficulty was excessive sensitivity of the equipment, particularly the klystron, to changes in the level of the supply voltage. It was then the practice to operate the klystron in a single mode by applying a fixed d.c. bias, of the order of 300 volts, to the klystron repeller. An a.c. modulation of approximately 15 volts, peak to peak, amplitude was superposed upon this level. The bias was applied by means of dry batteries and potentiometers, but the arrangement could not be depended upon to supply exactly the same amount of bias at all times. It was not unusual for the bias voltage to change sufficiently, during the period of operation directly connected with a firing, to cause a drop of 40% in the power output of the klystron. A 15 volt (5%) change in repeller voltage would completely detune the oscillator. In the October 10 flight, the fixed bias was eliminated and an a.c. modulation of 200 volts, peak to peak, amplitude was applied to the repeller, causing the klystron to pass through three to five modes of oscillation per cycle. With this design a 15 volt decrease in the modulation voltage caused a drop of only 25% in output power. This arrangement was clearly less sensitive to repeller voltage fluctuations than was the previous one. A further increase in reliability was obtained by replacing the dry batteries with a 24 volt dynamotor.

*Naval Research Laboratory Confidential Report No. R-2956(1 October 1946).

UNCLASSIFIED

The gain of the system was increased materially, making it possible to place an attenuator pad between the klystron and the wave guide system. This latter change was important, since it served to isolate the klystron and its monitor from the external system in general, and specifically from variations in effective output impedance caused by changes in the amount of radio energy reflected by the flame.

The electronic equipment, comprising the klystron, monitor, receiver, and voltage regulator tubes, was mounted on a single chassis. The circuit diagram is given in Fig. 1, and photographs of the chassis and the warhead mounting appear in Figs. 2 and 3. The dynamotor was shock mounted and located separately from the electronics.

A test unit was developed which greatly facilitated the maintenance of the equipment. It enabled one to check telemetering outputs, regulated voltages, and filament and dynamotor voltages.

3. Experimental Results. The telemetering record indicated that the equipment operated properly during the first twenty-five seconds of flight. The telemetered receiver voltage then decreased, over a period of 8 to 10 seconds, to the Edison effect value. It continued at this level for the remainder of the flight. The output of the klystron was monitored and had a constant value throughout the flight, indicating that the klystron operated properly and that the correct filament and plate voltage levels were maintained.

The data obtained during the first twenty-five seconds show that the signal experienced an attenuation of about 11 db, with a modulation of ± 2 db, in the jet exhaust flame of the V-2. Fig. 4 is a reproduction of a portion of the telemetering record of the October 10 firing corresponding to the period immediately before takeoff. The attenuation caused by the igniter flame may be clearly seen. An attenuation of 13 ± 2 db was measured in the July 30 firing. The data gathered in the two experiments are plotted in Fig. 5. Since the flame is approximately 80 cm. in diameter at the point of measurement, the attenuations may be expressed in decibels per meter by multiplying the values there given by $5/4$.

4. Conclusions. As can be seen, the same sequence of events occurred at both firings. The igniter flame caused a very severe attenuation, of magnitude greater than 30 db, as well as some bursts of modulation. The attenuation then diminished, approaching a constant level as the rocket started to rise from the ground. The values of attenuation measured on the two flights agree as to order of magnitude. Since, however, information concerning the temperature of the flame is not available in either case, they are actually not readily susceptible to direct comparison*.

*Op. cit., p. 4.

100

5. Future Research. The present series of measurements of the attenuation of 10,000 mc. radiation in the exhaust flame of the V-2 will continue. They are to be supplemented by experiments designed to determine the attenuation of radiation at the frequencies presently used for telemetering purposes. These include the frequencies in the range from 1020 to 1040 megacycles.

5. Future Research. The present series of measurements of the attenuation of 10,000 mc. radiation in the exhaust flame of the V-2 will continue. They are to be supplemented by experiments designed to determine the attenuation of radiation at the frequencies presently used for telemetering purposes. These include the frequencies in the range from 1020 to 1040 megacycles.



CONFIDENTIAL

UNCLASSIFIED

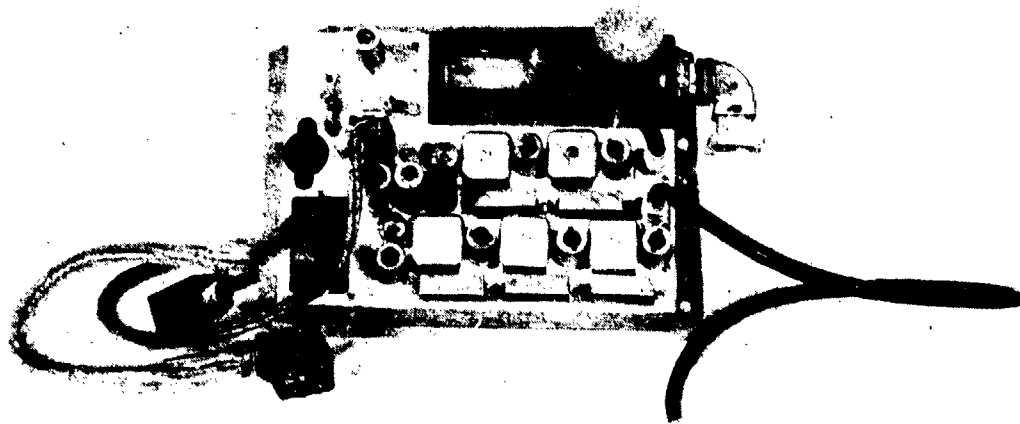


Fig. 2 Ionization Electronic Equipment

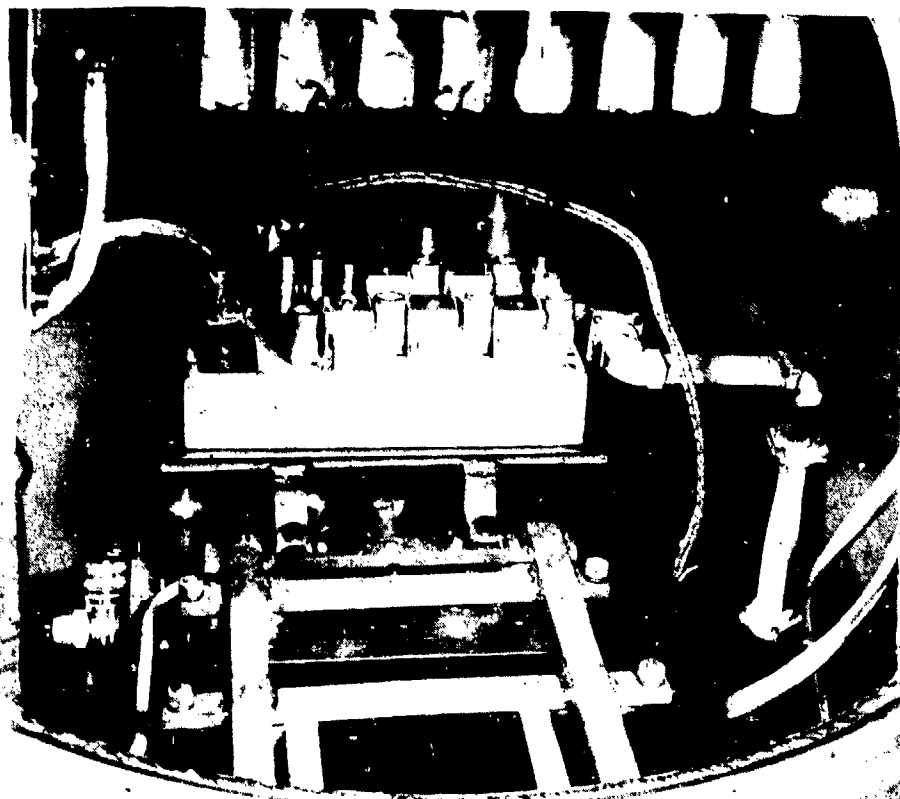


Fig. 3 Warhead Installation Showing Electronic Equipment and Waveguide

UNCLASSIFIED

KLYSTRON MONITOR CHANNEL

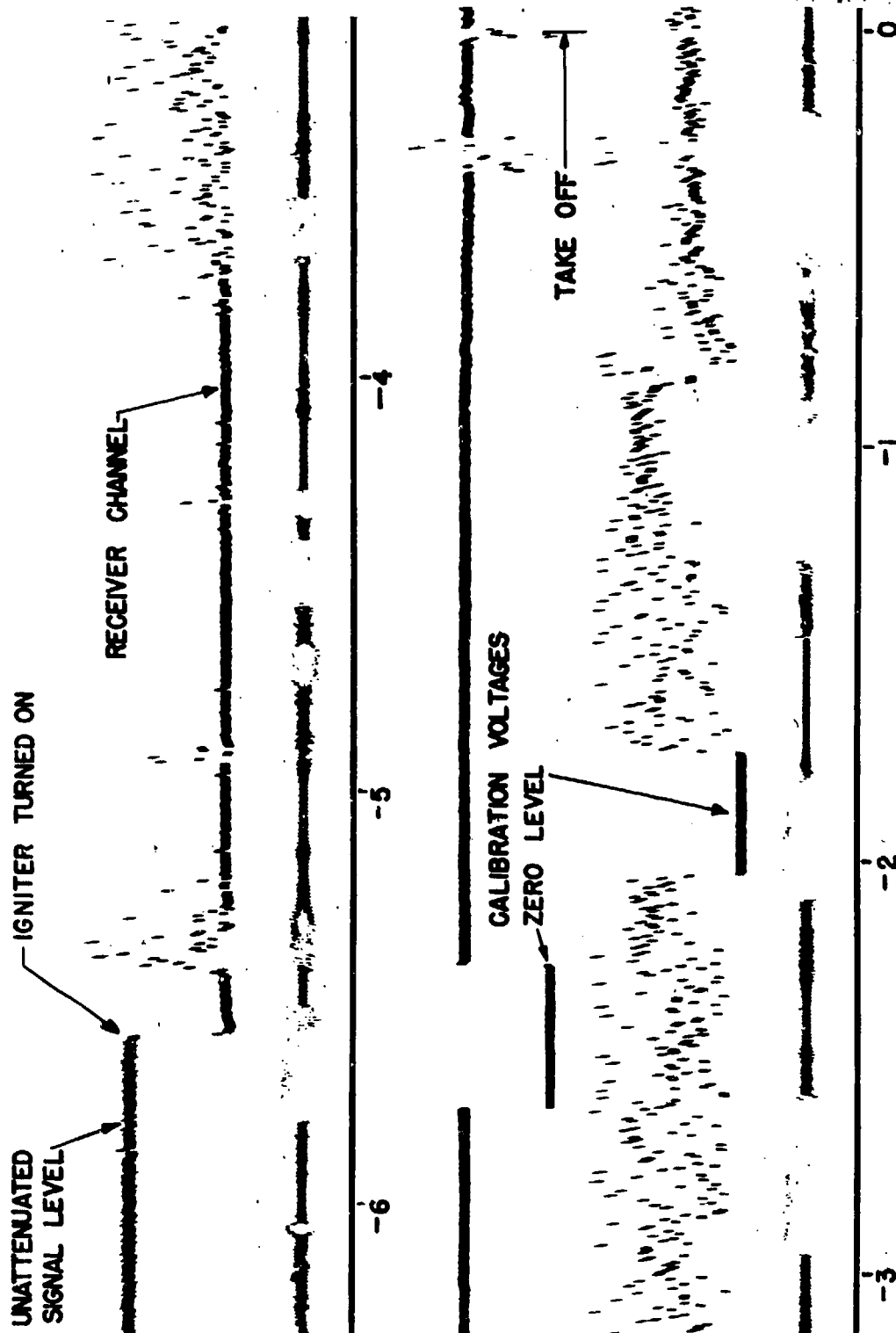


Fig. 4 A Section of the Teletyping Record. The Features of Interest have been Labelled, and a Scale Indicating Time in Seconds before Takeoff has been Added

CONFIDENTIAL

UNCLASSIFIED

UNCLASSIFIED

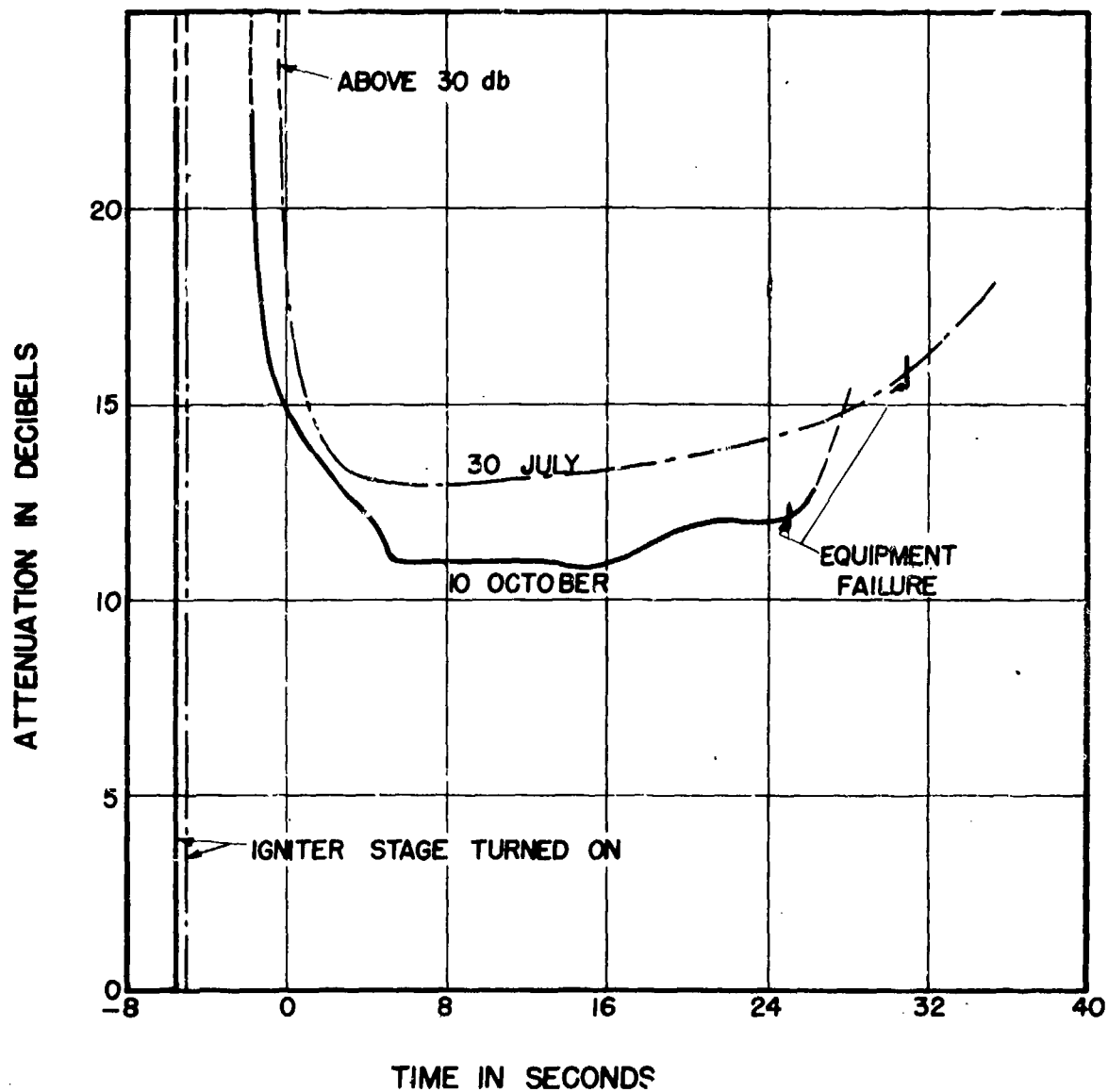


Fig. 5 Attenuation of 10,000 mc Radiation in the Exhaust of the V-2 as a Function of Time

CONFIDENTIAL

TITLE: Upper Atmosphere Research Report No. 11 - Part II - Ionization Experiments

AUTHOR(S): Becker, M.; Boardman, R. E.

ORIGINATING AGENCY: Office of Naval Research, Washington, D. C.

FURNISHED BY: (Same)

ATL: WW

(S)

R-111

(S)

Dec '46

Conf'd

U.S.

En3.

14

photos, diagrams, graphs

ABSTRACT:

Experimental data on attenuation of 10,000 megacycle radiation in context of V-2 missile in flight are discussed and plotted. Important additions and changes incorporated into missile in second cycle of V-2 firings are given. Drop in power output of klystron is lessened by eliminating fixed bias, applying an AC modulation of 200 volts, peak to peak amplitude to the repeller, and by replacing dry batteries with 24-volt dynamotor. For first twenty-five seconds, equipment operated properly, then telemetered receiver voltage decreased to and remained at Edison effect value.

DISTRIBUTION: Copies of this report obtainable from Air Documents Division; Attn: MCDXXX

DIVISION: Guided Missiles (1)
SECTION: Operation (13)

SUBJECT HEADINGS: Missiles, Guided - Test vehicles (68880.8); Atmosphere, Upper - Research (18003); V-2 (03078)

ATI SHEET NO.: C-1-13-1

Air Documents Division, Information Department
Air Materiel CommandAIR TECHNICAL ENGINE
CONFIDENTIALWright-Patterson Air Force Base
Dayton, Ohio

Rec'd
10/27/2000

**Naval Research Laboratory
Technical Library
Research Reports Section**


DATE: October 10, 2000
FROM: Mary Templeman, Code 5227
TO: Code 7600 Dr Gursky
CC: Tina Smallwood, Code 1221.1 *ps*
SUBJ: Review of NRL Reports

Dear Sir/Madam:

1. Please review NRL Reports R-3030, R-3031, R-3120, R-3139, and R-3358 for:

- ☒ Possible Distribution Statement
☐ Possible Change in Classification

Thank you,



Mary Templeman
(202)767-3425
maryt@library.nrl.navy.mil

The subject report can be:

- ☒ Changed to Distribution A (Unlimited)
☐ Changed to Classification _____
☐ Other:


Signature

10 Oct 2000
Date